proportion of bunches only a part is living, the dead parts being of a brownish color.

Captain Dagnall's statements were confirmed by Captain George Morrison of the R. M. S. P. steamship *Berbice,* who had been in charge of steamers between Jamaica and Southampton as well as of a steamer plying between Jamaica and the Canaries. But he thinks that patches of weed one acre in extent are very rare, and he was unwilling to assert that he had ever seen one larger than half an acre. In his opinion the gulf weed is torn off from the Bahamas by the waves and the greater part of it is swung around those islands. The writer's own observations agree with this, for in passing through the Bahama archipelago along the seventy-fourth meridian, he found the seaweed much more abundant than along either of the lines followed across the sargasso. The weed is evidently the same, being in circular bunches up to 18 inches diameter arranged in strips according with the direction of the wind, though occasionally in bands or even in patches 8 by 10 feet. The patches are near the large islands.

Seaweed occurs abundantly off the coast of Venezuela. It comes from the borders of the Orinoco delta and it was seen on the return voyage at about west longitude 62°. Thence it was very abundant to near the sixty-sixth meridian, where it disappeared abruptly and no more was seen except a small area near the seventy-second. The abrupt disappearance is difficult to explain; it is not due to decay, for the last exhibition was of apparently fresh weed; the distance from the source is too small to justify the supposition of decay, for the gulf weed is still living after having traveled from the Bahamas round to the east side of the sargasso. This is not the gulf weed, to which it bears no resemblance.

At best, the quantity of weed seen at any locality is wholly insignificant. Midway in the sargasso sea, the bunches seen in a width of a mile would form, if brought into contact, a strip not more than 65 feet wide. This, where the weed is most abundant. But the bunches are very loose, the plant material, as was estimated, occupying less than one fifth of the space, so that if the bunches were brought together so that the plant parts would be in contact, each square mile would yield a strip not more than 13 feet wide and 3 or 4 inches thick, or barely 2,500 cubic yards of uncompressed seaweed to the square mile. In most of the area traversed, the quantity would be but a small fraction of 2,500 cubic yards to the square mile—and the conditions are the same along the lines described by Captains Dagnall and Morrison. The accumulation of decayed vegetable material from seaweeds must be comparatively unimportant under the sargasso sea; and what there is would be merely foreign matter in mineral deposits.

The trade winds are comparatively gentle in early July, and the latter part of August, when the writer made the voyages; but they are sufficient to raise waves of five to eight feet and the sea is covered with "white caps." Later in the season the winds become much stronger. Reasoning *a priori,* one can hardly conceive it possible that, with the water in constant motion, the floating débris could accumulate *en masse* over any considerable area; even should such accumulation take place during a period of comparative quiet so as to protect the water from wind, it would soon be broken up by wave attacks along the borders; for the patches of weeds are not matted like peat—they are merely agglomerations of loose bunches drifted together.

JOHN J. STEVENSON

IS THERE DETERMINATE VARIATION?

UNDER this title I published in SCIENCE four years ago[1] a paper discussing the changes from year to year in the color pattern of the beetle *Diabrotica soror* as these changes had been observed by me during the decade 1895–1905. The observations depended on the collection each year (1896–1900 omitted) at approximately the same time and place (in the later years two separate places each year) of series of 1,000 individuals, and the determination and tabulation of the color-pattern

[1] Vol. XXIV., pp. 621–628, November, 1906.

conditions. A progressive change from one condition to another was noted and the question was asked if this change were not an example of determinate variation. The other possible explanations, *i. e.*, natural selection and temporary ontogenic modification, were considered and held to be inapplicable.

I have continued the annual inspection of the color pattern status of the beetle since 1905 and present in the following notes the results of the observations of the last five years (1905–10). In order to make reference to the earlier paper unnecessary to hurried readers I résumé in this the data of the 1895–1905 observations and repeat two or three paragraphs of explanation.

The beetle *Diabrotica soror* is a chrysomelid species that infests our California flower gardens.

In its larval stage this beetle lives as a slender white grub underground, feeding on the roots of alfalfa, chrysanthemum and various other plants. It pupates in a small subterranean cell near the surface and the adult beetle, on issuance from the pupal cuticle, makes its way above ground and feeds on the buds and open flowers of roses, chrysanthemums and almost any other of California's favorite blossoms. The color pattern of the adult is, of course (as the insect is one of "complete metamorphosis"), definitive and fixed as to both pattern and color at the time of the first appearance of the adult above ground.

This beetle has its black and green colors arranged on its back (dorsal surfaces of the wing-covers) in the form of twelve distinct black blotches or spots on a green ground, six spots in three transverse pairs (or two longitudinal rows) on each wing-cover. At least the original description of this species gives this patterning, and systematic accounts and revisions of the genus have always ascribed to the species *soror* twelve separate black blotches on a green (or yellow-green) ground. In Horn's revision of the genus in 1893[2] the fact of a tendency of the black spots to coalesce is fleetingly referred to. But undoubtedly the twelve-free spots type is the pattern which is accepted as the typical and usual one.

[2] *Trans. Amer. Ent. Soc.*, V., 20, p. 89 ff.

The pattern variation is shown (by selecting certain principal types appreciably distinct) in Fig. 1, where *A* represents the condition accepted by the systematists as typical of the species (both right and left elytra are shown); *B* shows the two spots of the middle transverse pair of the left wing-cover fused;

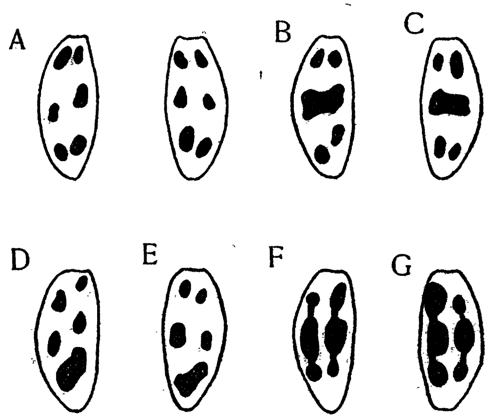

FIG. 1. Diagrammatic representation of the varying elytral color pattern of the California flower beetle, *Diabrotica soror.* (The ground color is green; the spots are black.)

C, the corresponding two spots of the right wing-cover fused; *D,* the two spots of the posterior transverse pair of the left wing-cover fused; *E,* the corresponding spots of the right wing-cover fused; *F,* the longitudinal fusing of the spots on the left wing-cover, and *G,* the corresponding condition for the right wing-cover.

These different patterns are closely connected by intergrading conditions; that is, there may be (theoretically) and are (actually) all degrees of fusion of the two spots in these various pairs that show fusion at all, from the slightest running together to the more pronounced cases shown by the diagram. But for the sake of aggregating individuals into describable groups any fusion is called fusion, and the existence of even the slightest space or line of green between two spots is recognized as "no fusion" or "free

spots." As a matter of fact, in the great majority (about five sixths) of cases of fusion the spots are well joined.

In the following tabulation of condition of the varying color pattern in the species (on the Stanford University campus) in different years, series of approximately 1,000 are used. That a series of 1,000 individuals collected from one locality at one time fairly represents, in the variation revealed by its members, the actual variation conditions of the species in this locality, as regard both kinds of variation and frequency of these kinds, is proved by repeated tests made by examining and tabulating successive thousands taken at random from the same place at the same time and finding a practical identity in these separate lots. Indeed, series of 500 gave practically approximately the same proportions as those of 1,000. But the larger number is the safer. All the lots not otherwise noted were collected on flowers in approximately the same place on the campus. All the lots were collected in October.

The following tabulation gives the data for all the series examined since 1895.

That the relative frequencies of the principal two pattern conditions may be more readily obvious I present in the following table the percentages of these types for each of the lots studied.

Year (Oct.)	Number of Individuals in Lot	All Spots Free	Middle Spots of both Elytra Fused	Middle Spots of Left Elytron Fused	Middle Spots of Right Elytron Fused	Miscellaneous[1]	Notes
1895	905	383	203	55	64	200	On campus flowers.
1901	905	313	396	32	60	104	On campus flowers.
1902	905	313	388	40	55	109	On campus flowers.
1902	405	228	105	12	18	42	This lot was collected at Santa Rosa, Cal., sixty miles north of the Stanford campus.
1904	1,546	442	832	41	63	168	On campus flowers.
1905	1,000	352	465	43	52	88	On campus flowers.
1905	1,120	301	604	56	73	86	This lot was collected on *Baccharis* about two miles from the collecting ground for the other lots.
1905	1,005	491	306	43	57	108	This lot was collected at San Jose, Cal., twenty miles south of the Stanford campus.
1906	516	181	215	27	27	66	On campus flowers.
1907	786	282	344	32	55	51	This lot was collected on *Baccharis*.
1908	413	162	127	30	36	58	On campus flowers.
1908	594	319	127	31	38	79	This lot was collected on the *Baccharis*.
1909	1,128	485	393	61	69	60	On campus flowers.
1909	999	358	417	64	60	100	This lot was collected on the *Baccharis*.
1910	953	449	303	33	55	113	On campus flowers.
1910	1,093	458	363	48	67	157	This lot was collected on the *Baccharis*.

Years	All spots free	Middle spots fused
1895	42.35	22.40
1901	34.05	43.70
1902	34.04	42.80
1902 (Santa Rosa)	56.29	25.92
1904	20.90	65.40
1905	35.20	46.50
1905 (Baccharis)	26.87	53.92
1905 (San Jose)	48.85	30.45
1906	35.08	39.73
1907 (Baccharis)	35.88	43.76
1908	39.20	30.75
1908 (Baccharis)	53.70	21.38
1909	43.00	34.93
1909 (Baccharis)	35.83	41.74
1910	47.11	31.80
1910 (Baccharis)	41.90	33.21

[1] Lateral fusion of anterior or posterior spots; longitudinal fusions, etc.; always includes some cases of lateral fusion of middle spots accompanying fusions.

From the preceding tables it will be seen that the statement in my earlier paper (1906) based on the data for 1895–1905 was true. But this statement can not be repeated for the series 1906–10. The statement made in 1906 is:

> If series of 1,000 really reveal the variation conditions of the color pattern in the species in these different years (and our check lots show that they do) it is apparent from these statistics that *Diabrotica soror*, in this particular locality, has in ten years changed from a form in which one pattern type was the mode to one in which another is the mode. And this change has been gradual and cumulative; not made by a mutation or by discontinuous variation, *i. e.*, discontinuous evolution. The two modes or predominant types of pattern are connected to-day as they were ten years ago by all degrees of gradations; the variation, that is, is typically continuous or "Darwinian" in type.

Since 1906 this change from all-spots-free to middle-spots-fused has not proceeded nor even maintained itself. In 1908, 1909 and 1910 the lots studied from the campus flowers have all shown a predominance of the all-spots-free type. That is, the mode has swung back to the 1895 condition, or we may say, the species type. In the light of this fact, and in the suggestive light of the conditions presented by the lots taken from the Baccharis two miles away from the campus flowers and by the lots taken at Santa Rosa and San Jose in 1902 and 1906, it seems obvious that my case of determinate variation resolves itself into a case of fluctuational variation determined in one direction, then in another, in some way by a probably varying environment (using the word in a broad sense to include varying temperature, humidity, food supply, etc., during larval and pupal life of the beetles). There is no indication just what influence it is during immature life that is modifying the imaginal color pattern in this very definite and wholly unadaptive way, but some such influence must be behind the variation. It is certainly no inherent modifying principle working toward a purposeful or even purposeless goal, because it does not work consistently. And yet it is no such simple modification of a total color tone by low temperature or high humidity as I have been able to produce experimentally in certain insects of incomplete metamorphosis, *e. g.*, *Murgantia histrionica*, the harlequin cabbage bug. It is a variation determined in certain alternating directions by a changing environment, by extrinsic influences working non-adaptively and unreasonably—may I say?—that is, producing changes that are not such as our knowledge—lamentably incomplete, to be sure—of the relation of varying food, temperature, humidity, light intensity, etc., to insect colors, enables us to prophesy.

The beetle still presents to me, therefore, an enduring interest even if it be not behaving in the way suggested by my questioning use in 1906 of the phrase "determinate variation."

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SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 474th regular meeting of the society was held in the hall of the Cosmos Club on November 12, 1910, with President T. S. Palmer in the chair and a good attendance of members.

Under the heading "brief notes," Dr. Barton W. Evermann reported continued success in keeping the two fur seals from the Pribilof Islands, which were received at the Bureau of Fisheries last spring. He reported also that ten more seals had been brought from the north on the revenue cutter *Bear* and landed safely at Seattle. Of these seven are now feeding well and the other three less satisfactorily. It is intended to distribute the ten as follows: two to Golden Gate Park, San Francisco; two to the New York Aquarium; four to the National Zoological Park, Washington, D. C.; and two will be left at Seattle, if suitable accommodations for them can be provided.

The following communications were presented:

A New Jaguar Record for Texas: VERNON BAILEY.

The present record is of a large specimen of the jaguar killed last spring in central Texas, near London, Kimble County, not far from the Llano River. Mr. Bailey showed a lantern slide photograph of the dead animal and also a map showing localities of the principal records for this animal within the United States. The jaguar formerly